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Federal Aviation Administration

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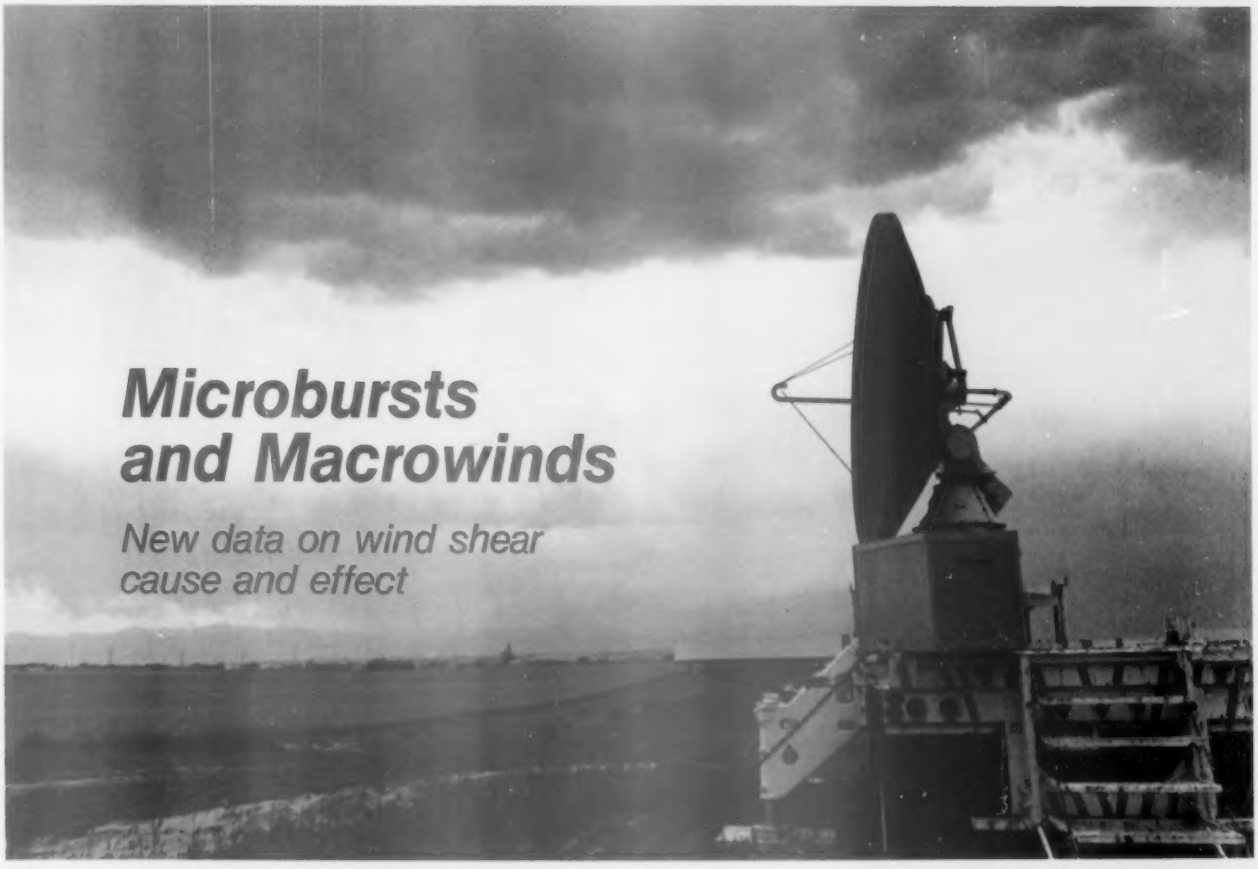
ALTERNATOR ALTERNATE? One alternator is like another, right? Wrong. Especially so if you install an automobile alternator in your airplane. Even though they do the same job, they do it a little differently. For example, aircraft engines turn opposite to automobile engines, so the internal cooling fans have to canted at a different angle. Pulley and belt sizes vary, as do the brushes, and those on the airplane alternator have a higher graphite content. Airplane alternator rotors are shorter; their threads are smaller and wound opposite from auto alternators. Because these (and other) differences are significant, using an automobile alternator in an aircraft is an unsafe (and unapproved) practice.

SNIFFING OUT LEAKS. Sport ballooning continues to report accidents and serious injuries caused by improper storage of propane. There is often some leakage of vaporized gas from stored tanks, and since the gas is heavier than air it tends to concentrate in confined areas, where the slightest spark could set off a violent explosion. Gondolas, garages, storerooms, car trunks or truck beds are not advised for tank storage. Follow manufacturers' instruction for proper care. Propane is identified by a distinctive odor that is evident long before the concentration becomes explosive. Nose it out.

HEARING THE CALL. One fourth of the more than 2,000 pilot/controller misunderstanding incidents reported over a period of four years by the FAA/NASA Aviation Safety Reporting System were attributed to errors in call-signs, either by the pilot or controller. Always state the aircraft type, model or manufacturers' name, followed by all the digits and letters of the registration number, e.g., Bonanza one, two, three, seven Alpha Zulu. Avoid abbreviations, especially in congested traffic areas.

UPPED ANTE. Two-and-a-half years after offering a $10,000 prize for the first human-powered helicopter and getting no takers, the American Helicopter Society has sweetened the pot to the tune of $15,000. Three designers are currently working on the prize requirements but keeping their muscle-powered 'copters under wraps. To win the money, the motorless helicopter must hover for a full minute within a ten-meter square and attain an altitude of ten meters above ground level.



Microbursts and Macrowinds

New data on wind shear cause and effect

There is a new word in aviation weather: MICROBURST.

At first glance it might look like just a fancy or more dramatic way to describe familiar thunderstorm turbulence. But that is not the case, because *microbursts* have been identified as a special form of wind behavior which has previously eluded scientific understanding, and contributed to some of the most tragic aircraft crashes in U.S. aviation history.

At 4:07 p.m. on July 9, 1982, Pan Am Clipper 759, a Boeing 727 air carrier, began a takeoff roll on Runway 10 at Moisant International Airport. Moisant is located west of the city of New Orleans, with the Mississippi River to the south, Lake Pontchatrain to the north, and a large swamp to the west. The three-engine jet was observed making what appeared to be a normal liftoff and initial climbout from the 9,000 foot runway, breaking ground about 2,000 feet before the departure end. After reaching an altitude of between 100 and 150 feet above the ground, Clipper 759 began to descend slowly, struck a tree 50 feet above the surface and crashed into a residential area. The impact and fire killed 145 persons on board the aircraft and 8 persons on the ground.

The subsequent investigation by the National Transportation Safety Board was exhaustive, utilizing statements from over a hundred witnesses, data from flight data and cockpit voice recorders, aircraft maintenance logs, personnel records, laboratory analyses, tape recordings from Air Traffic Services and the National Weather Service, etc.

The Safety Board concluded that:

- The airplane was certificated, equipped and maintained in accordance with FAA regulations and approved procedures. There was no evidence of a malfunction or failure of the airplane, and it was within gross weight takeoff limits.
- There was no evidence of any pre-existing medical or physiological condition that might have affected the flight crew's performance, and the crew was properly certificated and trained. (The captain, 45, had logged 11,727 hours of flight time, almost all of it in the B-727. The first officer was similarly qualified on the aircraft.)
- The air traffic controllers on duty in the New Orleans tower had received the training and off-duty time prescribed by FAA regulations.
- The captain had received adequate weather information from his company and air traffic control to make an adequate assessment of weather conditions at the airport.
- The captain was aware that low level wind shear alerts were occurring periodically around the airport.
- The captain's decision to take off was reasonable in light of the information that was available to him.

In the absence of any mechanical or human failure, the Board concluded that, "The probable cause of the accident was the airplane's encounter during the liftoff and initial climb phases of flight with a *microburst-induced wind shear* which imposed a downdraft and a decreasing headwind, the effects of which the *pilot would have had difficulty recognizing and reacting to in time for the airplane's descent to be arrested before its impact with the trees.*" (Italics added.)

Wind shear (or wind shift) is defined generally as an abrupt change in wind speed and/or direction. When associated with a thunderstorm, shear occurs as a result of the strong downdrafts which take place during the mature or terminal stages of the storm. As the downrushing winds approach the earth's surface they fan out horizontally in all directions, at varying velocities, creating an area of vertical and horizontal shear for many miles around. An additional shear area is usually contained within a "gust front" moving from 5-15 miles in advance of the storm (Figure 1). Typically, the aircraft which encounters wind shear at an altitude below 1,000 feet first experiences an increase in headwind, then a downdraft,

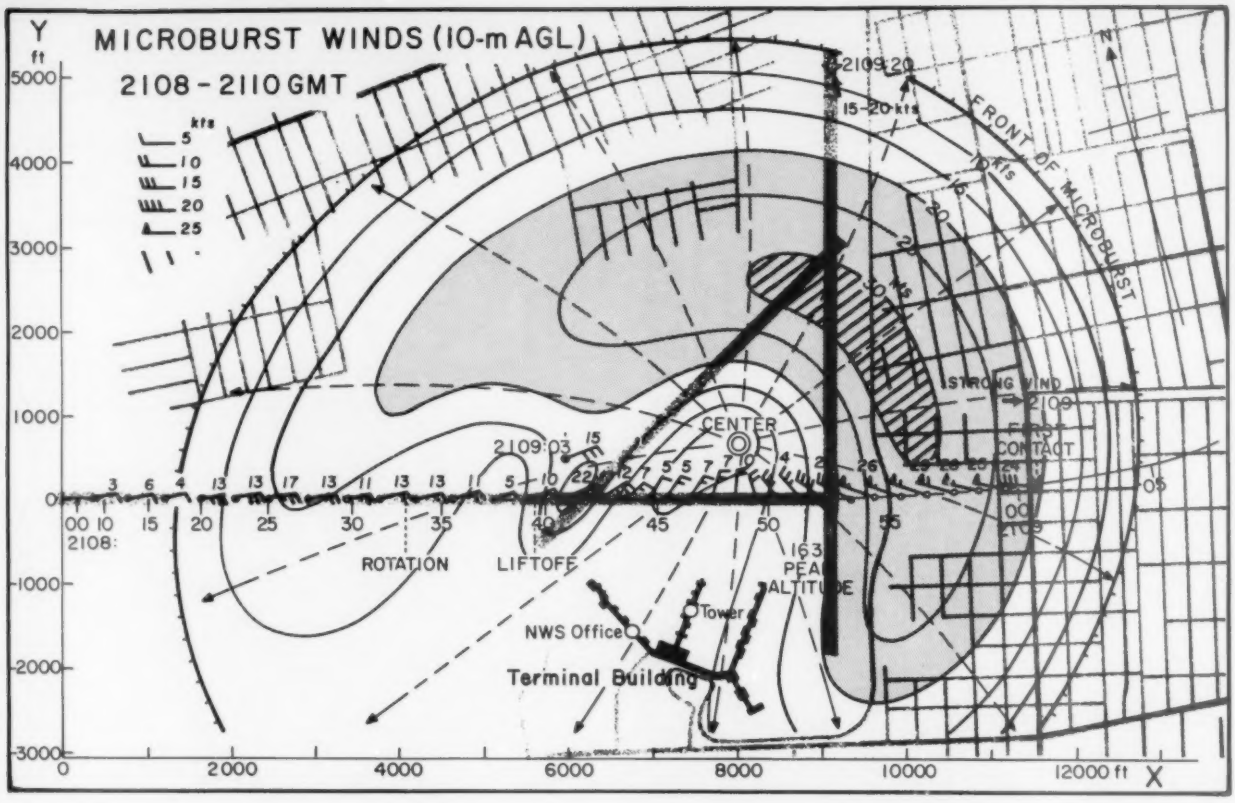


Figure 1. *Computerized depiction of microburst over New Orleans during clipper 759 accident, as drawn by Professor Fujita. As aircraft departed runway 10 (left to right), microburst was centered just north of departure end, where a tailwind in the order of 30 knots was experienced. X indicates crash site.*

and finally a tailwind. Inability to cope with this type of turbulence has led to critical loss of lift on takeoff or landing. See Figure 2.

A rash of such accidents in the 1970's culminated in the crash, in 1975, of Eastern Airlines' Flight 66 as it was preparing to land at JFK Airport in New York City. The jet encountered strong wind shear, dropped below the guide slope and crashed into the approach lights, killing 113 persons. Shortly afterwards FAA began installing an automatic system for detecting wind shear at airports at 58 major terminals across the country.

Basically this Low Level Wind Shear (meaning low *altitude*, not low intensity) Alert System consists of a centrally located anemometer (wind direction and speed sensor) and five peripheral sensors located from one to three miles distant from the centerfield sensor. A computer in the tower compares the averaged wind vectors (wind speed and direction) from remote sensors with the centerfield reading. When the difference exceeds a pre-determined figure an aural alarm is sounded and the comparative readings are displayed.

The instrumentation appeared to be helpful in dealing with this hazard, but some meterological scientists were concerned about whether low altitude wind shear was as yet fully understood. Normally the shear area of a thunderstorm is preceded by a gust front, but an analysis of the thunderstorm turbulence at JFK at the time of the Eastern accident did not confirm the presence of any ıch front. Additionally, Dr. Theodore Fujita, a prominent meteorologist from the University of Chicago, was puzzled by the fact that other aircraft landing shortly before Eastern 66 on the same runway experienced wind shear of markedly lesser force, or no shear at all.

Furthermore, conventional theory held that the downdrafts of thunderstorms began to dissipate at about 1,000 feet above the ground. But there was conclusive evidence that Eastern 66 had entered a strong downdraft while *descending through 400 feet AGL*.

After a careful reconstruction of all the meteorological data associated with this accident, Dr. Fujita concluded that *some* thunderstorms are capable of developing short-lived but extremely intense "downbursts" of air currents which may descend to within 300 feet of the surface or even lower and then fan outwards radially at accelerated velocities. He called this combination of a "downburst" and "outburst" a *microburst*, in recognition of its short duration (five minutes or less) and small area of activity (one to three miles laterally). As with other thunderstorms induced turbulence, the microburst wind shear area would be moving with an overhead cloud mass, but the usual heavy rain associated with this phenomenon might not be visible close to the ground. A frontal gust could be present as part of the overall thunderstorm activity, but it would not be directly associated with microbursts.

Fujita estimated that the velocity of such a downburst could be over 100 knots, and that the outburst or lateral wind shear close to the ground could produce a sudden transition from head to tailwind as much as 50 knots. A jet aircraft could pass through the microburst shear zone in about 30 seconds. Turbojet aircraft are especially vulnerable to this condition on

approach, because of the four to eight second lag period required for spooling up the engine to full power. Piston driven general aviation aircraft, having less mass and more maneuverability, had once been believed less vulnerable to wind shear. But recent studies have suggested that many general aviation accidents attributed to "loss of control" may have been due to this phenomenon.

Dr. Fujita concluded that while some microbursts could be handled by skilled pilots, and some could be negotiated safely by pilots who were both skilled and forewarned, others could be simply too violent for safe passage. He believed it was important to develop tools for measuring the intensity of microbursts accurately and locating their position.

Radar was the obvious tool, but what kind of radar? Weather radar that indicates the *reflectivity* or mass of storm cells has been used for many years, but what was wanted now was a form of radar that could literally measure the wind—i.e. make it possible to pictorially display contours of windspeed and direction.

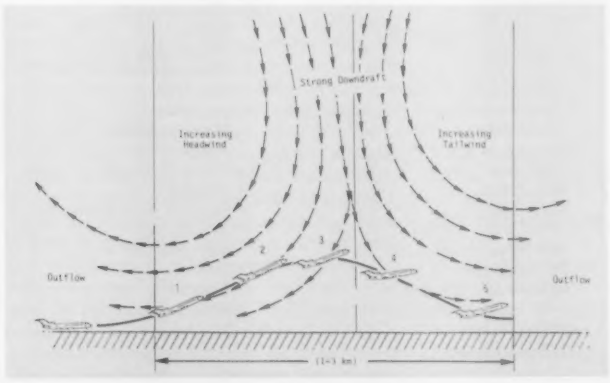
Since the early 1970's FAA had been testing acoustic, laser, frequency-modulated, and pulse Doppler radar, as well as other systems for possible use in wind shear detection. The so-called "Doppler effect" is the property of a moving object to modify certain energy waves beamed at it in accordance with its speed and direction from the transmitter. (For rough purposes of illustration, this is sometimes compared with the lowering of pitch in a train whistle as the train moves away from the station.) By transmitting with a very narrow beam, such as a laser, it is possible to target objects as small as the minute dust particles in the air—and so track the wind.

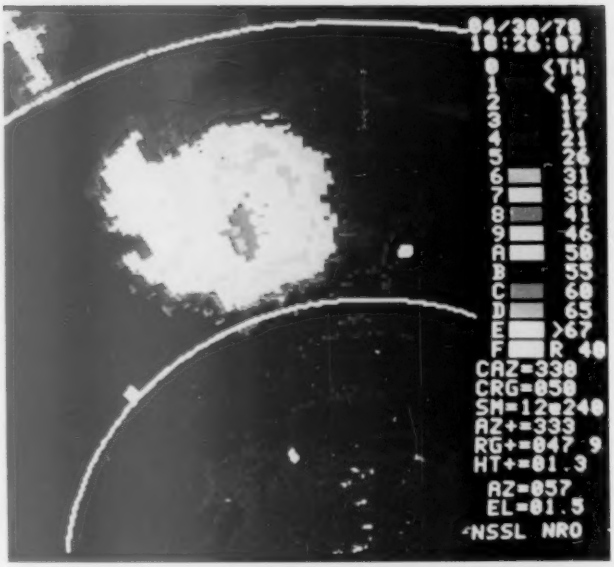
Experiments with such radars for studying microbursts were carried out by meteorologist James Wilson and his colleagues, working at the National Center for Atmospheric Research in Boulder, CO. For purposes of recognition, a computer was programmed to display wind activity by color. The result was a patchwork quilt-like representation from which it was possible to watch, time and chart the movements of wind shear turbulence.

While radar techniques for detecting microbursts were being perfected, another investigator at the Research Center, Dr. John McCarthy, was studying some of the aerodynamic effects of wind shear on aircraft. McCarthy found that for some aircraft the effect of the vertical air movement (when passing through a microburst) was to enhance the natural oscillatory ("porpoising") tendency of the aircraft. For the pilot who already has his hands full adjusting power and trim to rapidly changing winds, this can mean an additional and disturbing problem with control as the nose pitches up and down unexplicably.

In 1980 these three investigators, Fujita, Wilson, and McCarthy, began working together on a special meteorological study known as the Joint Airport Weather Studies (JAWS). The acronym is appropriate because, according to Dr. McCarthy, in the warm season microburst wind shear formations are always lurking somewhere around an airport, like sharks offshore. Any unwarned aircraft could become a victim.

To track down these "weather sharks," McCarthy and his colleagues established a field office at Stapleton International Airport in Denver. Eventually their "weaponry" included three Doppler radar stations, two Doppler lidars (lasers radars), some 50 ground-based reporting stations, and six specially instrumented aircraft. By the summer of 1982 they were





"Quilted" pattern from Doppler radar shows wind intensity.

concentrating on the as yet hypothetical microburst.

Their "catch" exceeded all expectations. During three summer months of 1982, utilizing all available radar and sensing systems, they were able to identify 186 microbursts on and around the airport. During one midsummer period of 48 hours they recorded no less than 25 successive microbursts—resulting in a temporary shutdown at the airport. Their findings reinforced the early theories of Dr. Fujita and provided many unexpected disclosures.

For example, it was learned that the horizontal outflow, or outburst, was frequently nonsymmetric, in contrast to earlier suppositions. The maximum diameter was little more than one mile when first detected, growing on the average to about two miles at peak intensity. It took approximately five minutes for the microburst to develop to maximum intensity and about ten minutes from that point for it to dissipate. Some microbursts of dangerous force were found to last only about two minutes altogether. Some were contained within a diameter of less than half a mile.

These findings helped explain why some aircraft in the same landing or departure sequence could be severely affected by wind shear, whereas others were not. They also made it clear why there were limitations to the usefulness of the existing wind shear alerting system: with only five peripheral reporting sensors at an airport, separated in many cases by several miles, it was always possible that a microburst wind shear could develop and dissipate without making its presence known to any of the sensors.

Perhaps the key observation, in terms of guidance for appropriate means of subsequent wind shear surveillance techniques, was that with the microbursts at least there is *no direct correlation between wind shear intensity and the strength, or reflectivity, of the storm cell "echoes" as seen on ordinary radar.* As often as not, microbursts occurred with downdrafts wherein the raindrops evaporated long before ground level—in that distinctive, wispy-cloud formation known as virga. It was now clear that

Figure 2. *Impact of microburst on departing aircraft. Vertical and tailwind shears require pilot to guard against loss of positive angle of attack.*

conventional airborne or groundbased radar could not be depended upon to predict the severity of microburst wind shears.

The catastrophic crash of Pan Am Clipper 759 on July 9 of 1982, unfortunately, occurred before the data assembled by the JAWS investigators could be studied widely, and applied to the prevention of wind shear accidents. However, testimony and data provided by JAWS experts was used to reconstruct the meteorological aspects of the calamity, and to establish the limitations of the detection devices in use.

According to the "windfield" of the New Orleans airport at the time of the Clipper 759 accident, drawn up by Dr. Fujita (see Fig. 1), a microburst was taking place over runway 10 just as the jet was starting its takeoff run. The center of the downburst, as indicated in the drawing, was located just north of the departure end of the runway. The somewhat egg-shaped outburst field extended about 5,000 feet east, about 6,000 feet to the north and the south and about 7,000 feet to the west. The microburst was traveling in a north-easterly direction, with winds of highest intensity (about 30 knots) blowing from the center to the northeast. At the point of liftoff (some 2,000 feet west of the microburst center) the 727 experienced a headwind in the order of nine knots. The Clipper was airborne for only 20.0 seconds, during which time the headwind changed to a tailwind of approximately 30 knots.

This microburst was described by the JAWS investigators as being "of moderate intensity." A contributing factor may have been the heavy rainfall over the runway end, estimated to have been at a rate of about 5 *inches per hour*. Current scientific theories assume that very heavy rainfall incurs penalties in lift and drag, due to roughening of the airfoil contours.

What does all this mean to the general aviation pilot? Whenever there are reports or forecasts of wind shear around an airport, be aware that highly localized microbursts may be present. They may not be directly visible to the naked eye, may not be identified by radar or weather satellite surveillance, and possibly not even by the wind shear alerting systems if any are present at the terminal. An unexpected encounter at low altitudes can lead to loss of control and ground impact.

How can you avoid encountering microburst wind shears?

Pay close attention to pilot reports and air traffic control updates on current wind behavior. Currency is the key word here, since microbursts come and go in a matter of minutes. Supplement these advisories with your own observations of wind shear indicators that are usually present on the ground or in the sky. The most obvious signs include circular patterns of outblowing dust; trees bent over double; heavy downpours or dark clouds with trailing wisps of evaporating rain (virga); contrary signals from wind sensors; and abrupt increases or decreases in airspeed, without change of power setting or trim.

For example, if during your approach to land you experience a sudden sustained increase in airspeed, causing the nose to pitch up, you should anticipate a possible abrupt transitioning through the downdraft and tailwind segments of a microburst wind shear. You should be cautious about reducing power or pitch angle, and ready to go to full power immediately and execute a go-around or missed approach, if conditions warrant.

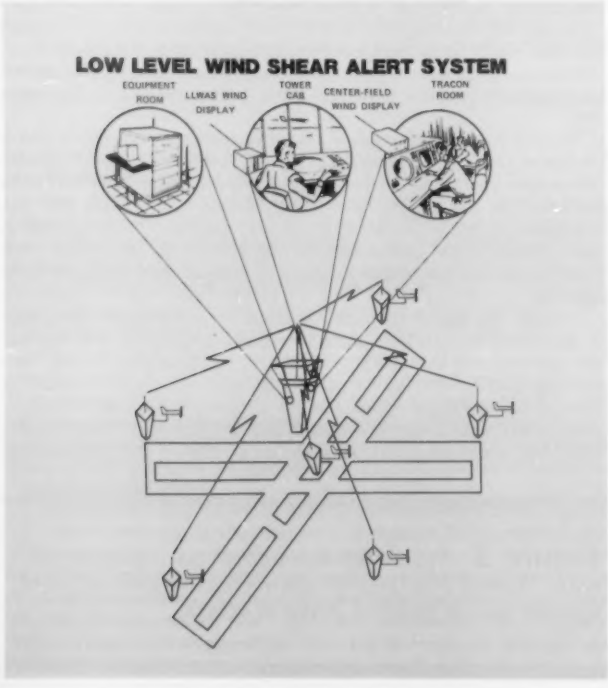
FAA's advisory circular on low level wind shear (AC 00-50A) notes that when an airplane flies into a downdraft, the relative wind shifts so as to come from above the horizon. This decreases the angle of attack, which in turn decreases lift, and the airplane starts to sink rapidly. In order to regain the angle of attack necessary to support the weight of the aircraft, pitch attitude must be significantly increased.

Such a pitch angle may seem uncomfortably high to a pilot. However, remember that the wing produces lift based on angle of attack—not pitch attitude. Once the pilot has pitched up sufficiently to stop the sink rate he must be alert to lower the nose of the airplane quickly when he exits the downdraft (and moves into the outburst). Otherwise the angle of attack will become too large and may result in a stall. (For further details you may obtain AC 00-5A free—see the article "More for Your Money" in this issue.

You can also update your knowledge on this subject by attending one of the numerous pilot safety seminars on microbursts which are currently sponsored by FAA's Accident Prevention Program around the country. Dr. McCarthy, of the JAWS investigating team, frequently appears at these meetings and his talks and graphic displays are very enlightening.

His bottom line on the ideal maneuver for dealing with these devious denizen of the sky is to set the parking brake and head for the pilot's lounge whenever there are any suspicious shear signs about. A brief delay is a small price to pay for keeping yourself out of the "shark's" maw. ■

(This article was written with the kind assistance of Dr. T.T. Fujita, Dr. John McCarthy, Mr. James Wilson, and Ms. Phyllis O'Rourke of the National Committee for Atmospheric Research, as well as FAA specialists.)



Existing Low Level Wind Shear Alert Systems

AL—Birmingham
Mobile
AZ—Phoenix
AR—Little Rock
CA—Los Angeles
CO—Denver
DC—Washington National
FL—Ft. Lauderdale (Int'l)
Jacksonville
Miami
Orlando (Int'l)
Sarasota
Tampa
West Palm Beach
GA—Atlanta
IL—O'Hare
IN—Indianapolis (Int'l)
IA—Des Moines
KS—Wichita
KY—Louisville
LA—New Orleans
MD—Baltimore
MA—Boston
MI—Detroit (Metro)
MN—Minneapolis
MS—Jackson
MO—Kansas City (Int'l)
St. Louis (Int'l)
NE—Omaha
NV—Las Vegas
NJ—Newark (Int'l)
NM—Albuquerque
NY—Buffalo
JFK
La Guardia
Rochester
NC—Charlotte
Raleigh-Durham
OH—Cincinnati
Cleveland (Hopkins)
Columbus
Dayton
OK—Oklahoma City
Tulsa
PA—Philadelphia (Int'l)
Pittsburgh (Int'l)
PR—San Juan
TN—Knoxville
Memphis (Int'l)
Nashville
TX—Dallas/Ft. Worth
Houston
Houston (Intercontinental)
San Antonio
UT—Salt Lake City
VA—Dulles
Norfolk
Roanoke
WI—Milwaukee

ICICLE WEATHER

Supercool pilots needed to deal with supercooled water

Besides being the season of snowmen and icicles and cheery fires at the hearth, in the northern half of the country at least, mid-winter is also the season when in-flight icing is most frequently encountered at low and middle altitudes. This is a consideration that every pilot who is flying home for the holidays must take seriously, because structural icing accidents have a very high fatality rate.

For pilots of most light general aviation aircraft, icing is simply something to be *avoided* in flight at all times. Even aircraft which are certificated for flight into known icing conditions have limitations to the de-icing capability of the equipment provided. What is officially described as "severe" or even "moderate" icing is usually too much for any but transport or air carrier categories of airplanes to handle. The engine heat, or electrical energy, or air pressure from light engines simply is not enough to cope with the rate of ice build-up.

The recently published report, by the National Transportation Safety Board, concerning the fatal crash of a Beechcraft *Super King Air* near Denver, CO is a case in point. The corporate turboprop took off in IFR conditions in light snow, with the surface temperature at 32°F and moisture reported extending up to 18,000 feet. An in-flight weather advisory (SIGMET) was calling for moderate to briefly severe icing in that eastern portion of the state. About 10 minutes after departure the pilots radioed an emergency because of airframe icing and were bectored back toward Stapleton Airport. However, the airplane impacted in an open field short of the airport. All 10 persons on board died in the crash and subsequent fire.

Radio transmission between the *King Air* and Denver Departure Control indicated that the aircraft was climbing through 12,000 feet when icing became a problem to the extent that the pilots could no longer maintain altitude. An emergency was declared, immediate descent was approved by air traffic control, and vectors were given to Stapleton, but apparently the airplane went out of control.

The Safety Board's investigation of this accident disclosed that the *King Air* was certificated for icing conditions and that there was no evidence of pre-impact mechanical failure or malfunction. The anti-icing and de-icing systems were properly installed and functional. Computer-derived data indicated that normal climb speed (160 knots) or higher had been maintained until the aircraft ascended to about 8,800 feet. After that the airspeed decreased at times to near or below the 140 knots recommended by the manufacturer as minimum safe speed in icing conditions, which indicated that ice was collecting on the airframe.

The Board believed that the airspeeds used above 8,800 feet resulted in substantially less-than-normal climb performance, and higher angles of attack than the 4° angle identified as critical by the manufacturer. These conditions would have permitted ice to accumulate on the (unprotected) underside of the wing. Since these accumulations could not be removed by the de-icing boots, the wing airfoil was severely distorted and the aircraft's ability to maintain level flight was destroyed. (A contributing factor was the decision to take off at 600 lbs. above maximum gross weight.)

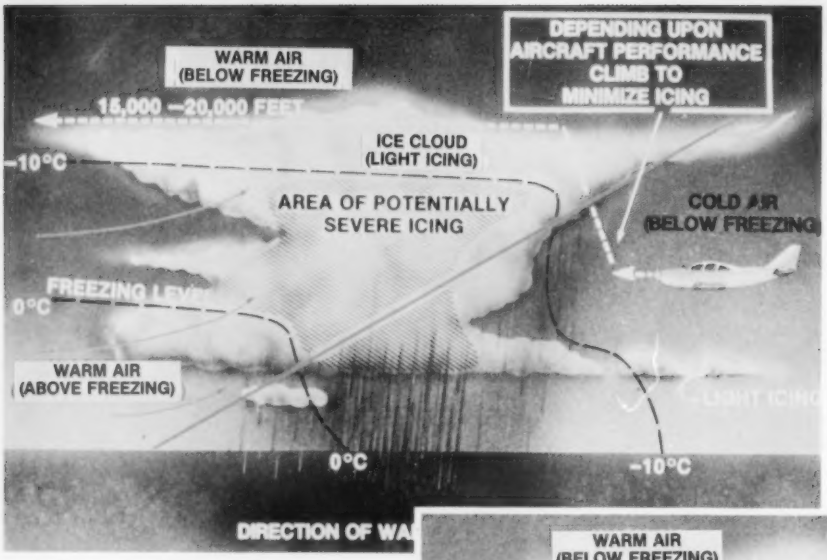
A section in the *King Air* Operating Manual notes that, "No airplane or combination of de-icing and anti-icing equipment can be designed for the worst possible icing that may be encountered—this condition cannot even be defined. . . . The prudent pilot must remain alert. . . . At the first sign that such conditions may be ahead, he should react by deciding on the most expeditious and safe course of action. The decision should be based on weather briefings, recent pilot reports, and ATC observations . . . It is the inexperienced or uneducated pilot who presses on 'regardless,' hoping that steadily worsening conditions will improve, only to find himself flying an airplane so loaded with ice that he can no longer maintain altitude . . ."

There are certain time-honored maxims concerning the avoidance of inflight icing that need to be examined. One of these is the belief that icing can only occur in clouds. *Usually* but *not always* true. You could be tooling along in your little airplane in VFR conditions, two or three thousand feet under an overcast, with the outside air temperature reading a couple of degrees above freezing when you encounter rain—rain that starts congealing on the windshield and airframe.

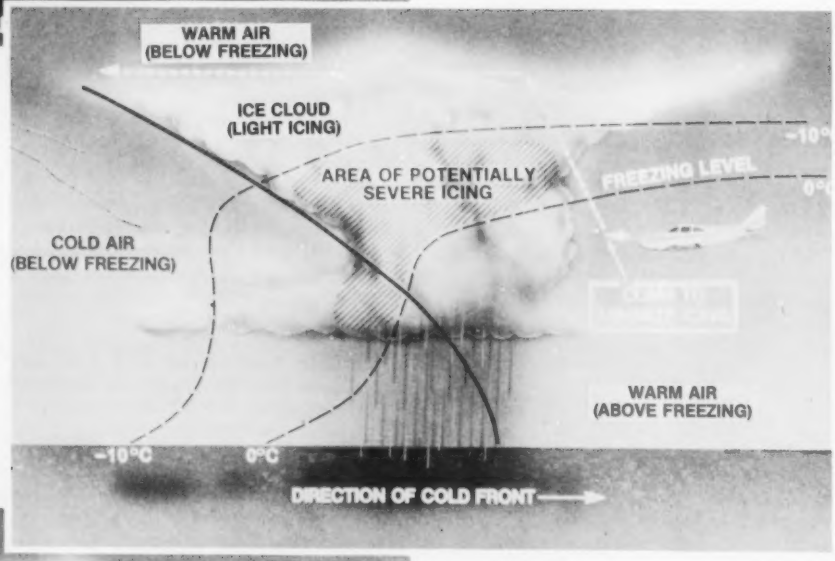
How is that possible? The rain may be falling from an altitude where the temperature is decidedly below freezing. So-called "supercooled" raindrops can remain in a liquid form until they spatter against something hard and cold, like your airplane, at which point they may crystallize and adhere, in the form of clear ice. Clear ice is hard to dislodge, even when you concentrate your entire cabin heater air supply on it. If you cannot fly out of freezing rain by doing a 180, you need to land quickly. Freezing rain is one of the most dangerous types of icing conditions, because of the vast amount of moisture available.

In point of fact, icing conditions aloft virtually always mean the presence of supercooled moisture, either in the form of rain or as the tiny

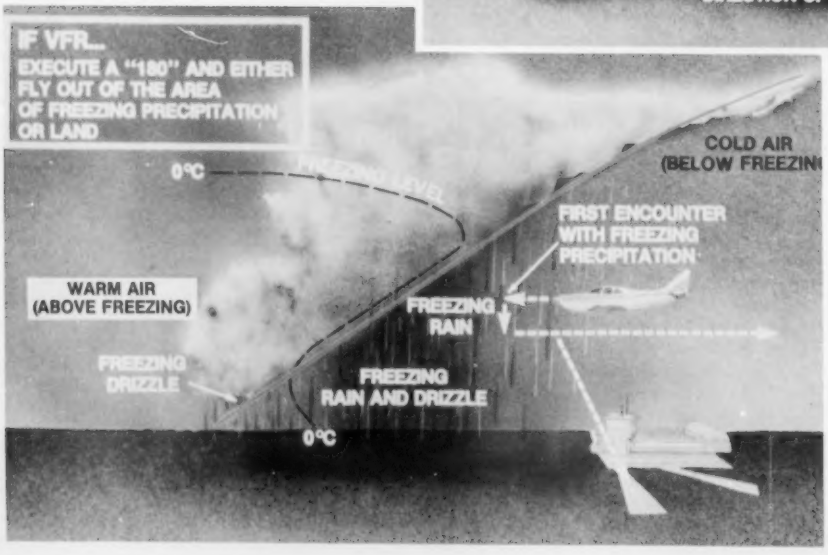
ICING CHOICES



Warm front scenario: Climbing out of freezing levels requires constant capability to maintain approved airspeed and angle of atttack



In winter, approaching a front head-on may mean penetrating a zone of potentially severe icing.


IF VFR... EXECUTE A "180" AND EITHER FLY OUT OF THE AREA OF FREEZING PRECIPITATION OR LAND
0°C
COLD AIR (BELOW FREEZIN
FIRST ENCOUNTER WITH FREEZING PRECIPITATION
WARM AIR (ABOVE FREEZING)
FREEZING RAIN
FREEZING DRIZZLE
FREEZING RAIN AND DRIZZLE
0°C

VFR-only pilots should discontinue a flight immediately if icing occurs.

droplets which make up clouds. In the winter low clouds may be made up entirely of droplets; middle altitude clouds contain both droplets and ice crystals; and high cirrus clouds are composed of ice crystals, all year around. Generally speaking the higher you go, the colder the air, and the less moisture. The maxim about "climbing out of icing" is based on the premise that the higher you go the less liquid will be available to freeze on your airplane.

The trouble with this maxim is that the weather-makers do not always honor it. Sometimes the air overlying your icing-in clouds condition is actually warmer than your icing layer—but still somewhat below freezing, which means that icing may be even more severe if you have not climbed clear of the clouds. Sometimes there are alternating layers of warmer and colder air. You have to keep an eye constantly on the OAT indicator and pray that the probe does not seal over with murky rime ice.

In a word, climbing up through clouds to get out of icing in a light plane is a gamble. Even if there is an inversion of really warm air reported on top, there is a chance you may not make it. As with the ill-fated *King Air* your angle of attack may expose more unprotected airfoil to icing which you cannot see, and become aware of only through diminished climb capability. The instant 180 and/or precautionary landing at the nearest airport is still your best bet. You may miss Santa's arrival at the old homestead, but that gentleman has been around for a long time and he probably will be there next year. Don't cross yourself off his list.

Similarly, flying over a cloud deck and under an overcast may not be such a good idea in winter. If you encounter precipitation, get burdened with ice and are forced to descend, you will need your IFR ticket plus a good sense of what you are doing. Icing raises the stall speed of aircraft and makes them more vulnerable to loss of control should you get into a steep turn. To avoid possible loss of instrumentation you will need a functioning pitot tube heater. You will want to remember to flex your controls from time to time to make sure they have not frozen, and cycle the propeller from low to high RPM, if you have adjustable pitch, it keep it from icing up.

If you are forced to descend through a cloud layer, plan to be in the clouds for as short a time as possible. Try to get a radar fix on where you are, so you can remain clear of the terrain, and advise ATC that you will be unable to accept any extended delays once you are in the clouds. Use carburetor heat if required to keep your engine power up—it is your only source of cabin heat for defrosting your windshield.

Statistics indicate that most icing accidents happen in the landing phase, although of course the contributing factors may have started at altitude. Not only may the aircraft be heavily laden with ice by the time you try to set up on final approach but you yourself may be pretty worn out with the anxiety and stress of coping in the clouds. Make the landing as easy on yourself as possible. Nothing fancy, just put it on the ground. Avoid whatever turns you can and keep them shallow in any case. Keep your airspeed a little on the high side. If on instruments, monitor your position carefully and try to avoid having to execute a missed approach—there is no telling what your ice load and your climb capability may be at this juncture and you want to minimize your exposure to additional icing. Be prepared to look out the side window if your windshield visibility goes to zero and you have to crab your way the last few feet down to the runway.

The terra firma will feel awfully good, and you will understand exactly what we mean when we say that anti-icing and de-icing equipment should be regarded as a way out of, not a way through, icing conditions.

Happy holidays! ■

(Editor's note: A full-color slide show on this subject, entitled "On Weather," is available on loan from your local Accident Prevention Specialist, or Flight Standards District Office.)

Ice build up on the windshield may be impervious to cabin heat. Pilot may have to look out side window for landing.

SATELLITE SAVES

Good news and bad news in the search and rescue business

Air Rescue and Recovery HUEY lifts off on a mission from Fairchild AFB, WA.

After a little more than a year's experience in locating distressed aircraft and marine vessels by means of space satellites capable of receiving emergency locator signals, the good news (as reported by the Air Force Rescue Coordination Center) is a whopping *40 percent increase in the number of distress signals which are being responded to by the Center.*

One U.S. and two Russian satellites now in constant orbit some 600 miles above the earth are coordinating emergency radio calls with ground stations in the United States, Canada and Europe (see "Finding Wayward Whuppers" in the July/August issue of FAA GENERAL AVIATION NEWS). As of November 1, a total of 102 save/assists have been credited to this worldwide program. A "save/assist" means that survivors were rescued either within a critical time or were given assistance while still in difficulty.

Data from the three satellites has not only stepped up the number of ELT signals heard and responded to, but has also reduced time-to-rescue by pinpointing the signal site with far greater accuracy than was possible with the use of ground or airborne receivers. The average accuracy of signal location is in the order of 12 nautical miles, and should improve with procedure refinement. Winter survival is especially time dependent.

Highlights from typical recent case histories of satellite-alerted rescue mission:

• An injured 11-year old boy, the sole survivor of a Cessna *Skylane* that crashed last August in northern Idaho with three fatalities, was attempting to crawl to safety when spotted by a rescue helicopter operating on satellite data. He was flown to a county hospital in time to save his life.

• A 58-year old pilot flying alone in a Grumman *Cheetah* crashed into a mountainside near Livermore, CA about 7:00 a.m. on July 1. He was incapacitated by severe injuries—broken skull, jaw and hip—but his ELT signal was picked up and coordinated by the satellites in time to effect a rescue by 2:30 p.m. And he survived.

• Three businessmen from New Orleans crashed their *Bonanza* at the 11,000 foot level of a Rocky Mountain peak in Colorado, in early April. Waist deep snow depth marooned them. Fifteen minutes after they were reported overdue on their flight plan, their ELT signal was picked up by satellite and two hours later they were located by rescue aircraft.

• Two young students from the University of Washington spent a shivering night in January in a canyon in the northern Cascade Mountains. They faced the prospect of indefinite isolation in deep snow and near zero weather, since the canyon walls blocked off much of their ELT's local transmission range. An Air Force helicopter, alerted by satellite receptors, airlifted them out the next morning after precise coordinates of their position were provided.

The bad news, however, is that the success of this satellite-aided tracking test program is still being threatened by a deluge of false alarms. During the first six months of 1983, with only one satellite in operation, the Rescue Coordination Center received and investigated 4,224 ELT signal incidents in the 48 adjacent states. These incidents generated 517 search missions and involved 794 flight sorties, on which 1,482 flying hours were expended. Only 18 of these search missions found signals that were actually activated by distressed persons.

After the second and third satellites started tracking ELTs on July 3, 1983, the daily average of signal reports rose close to 100, generating about 28 cases to be investigated per day. The false alarm rate has risen to the 97 to 99% range—producing an enormous wastage of search effort. The cost has to be reckoned in human lives as well as dollars: about three U.S. search pilots a year lose their lives in this effort.

Unless a solution to the high false alarm rate is found, the loss of time necessitated by this huge workload may eventually offset the gain in wider coverage and reduced time-to-rescue made possible by satellite tracking. This would be very unfortunate indeed, since the test program has brought to light the fact that the number of emergency signals picked up at random by overlying aircraft at high altitude is much smaller than had formerly been believed.

A special False Alarm Working Group has studied the problem and broken down the causes of inadvertent activations into four categories:

1. Mishandling of ELT	28%
2. Hard Landings	21%
3. Other G-switch Activations	16%
4. Unknown	35%

The first item refers primarily to the handling of portable units during storage in automobile trunks, garages, attics, etc. This sizable category (responsible for thousands of false alarms and

(continued on back page)

AT HOME IN THE SNOW

What it takes to survive a winter accident in cold weather

If you asked 100 pilots which time of year they would least like to be stranded in remote country after an emergency landing, probably almost all of them would say winter. It is bad enough to be down and lost, but if you add to this picture the prospect of ice, snow, bone-chilling winds, etc., you can easily imagine an inevitable sense of despair and resignation. Accustomed as we are to controlling our environment at the touch of a button or switch, most of us regard wintry landscapes as hostile to human life. Okay to visit for occasional skiing, sleighing or other organized sports, but no place to survive a crash, especially with injuries. This sense of alienation from cold, apparently lifeless, objects has been responsible for much unnecessary loss of life and suffering among persons who survive the initial impact of an airplane crash in near or sub-freezing conditions.

In point of fact, almost all components of a frosty, wintry scene have some potential for shelter. For example, *snow* is cold to the touch, but it has excellent insulation properties when properly used. *Ice* is not very nice to sit on, but it has good tensile strength for structural support. *Dead leaves* or *pine needles* are not as soft as a down coverlet, but do a fine job of preventing your body heat from being absorbed by the frozen earth. The *earth* itself, even when frozen, may offer protection against howling winds in the form of burrows or caves. In short, these aspects of our environment are not essentially antagonistic, but they appear so when our fear of the cold interferes with our ability to think, to adapt—and survive.

There is no question but that airmen who are habitually prepared for emergency survival—who regularly file flight plans, keep minimal supplies on board, dress for the outdoors and take survival courses—have a better chance of coming away from a remote crash in good shape than those who do not. Nevertheless, a response to an *actual* emergency, as compared with simulated circumstances, builds up far greater stress and makes many more demands on an individual's ability to tolerate discomfort or pain or fear and still function well. The human brain is a marvelous instrument, but in the presence of continued anxiety or depression it can become a pretty dull tool.

Supposing, for example, a pilot is forced down on a wintry plateau in a snowstorm, makes a decent landing and emerges unscathed. He has on board the latest style of mountaineering tent, a good ground pad and wool blanket, waterproof matches, axe, gun, dried food, water, flares, etc.—and, of course, he is wearing thermal underwear and insulated boots. He checks out the antenna of his ELT, which looks in good shape, and then sets about pitching his tent. Strong winds make this a problem for one person; the ground is frozen and the fresh snow is too wet to hold his stakes. The tent blows away from him several times, finally gets caught in some brush and rips. He tries to mend the rip in his new tent, but by this time his fingers are too cold.

So he decides to build a fire. Brush and trees are scanty, so he takes his axe and tramps off in the snow to find suitable firewood. By the time he has cut down a tree and hacked it up into lengths he can carry, it is dusk, and in the still-heavy snowfall he can no longer see the airplane. He abandons his wood and axe and races frantically around in the snow searching, but finds nothing. Eventually, exhausted, totally frustrated and damp with perspiration that is beginning to freeze, he slumps down and begins to go numb. Somewhere nearby, hidden by the snow and darkness, the cabin of the airplane contains warm blankets, food, everything he needed to survive the night.

An airplane crash, like a car crash, is a frightening, often traumatic experience under any circumstances, even when injuries are not serious. In responding to the emergency situation that follows, it is important to establish the priorities quickly, especially in a cold climate. Daylight is short in winter, the temperature drops sharply with the sunset, and you may have only a few hours, or even a few minutes, to establish your lodging for the night (a very different situation from the whole day you may have had in a practice session). An effective response can never be cut and dried; it must always be tailored to the realities of your present situation.

Consider, by way of contrast, an accident which happened this past November in Bristol Bay, Alaska. The pilot of a *Taylorcraft* decided to visit a small island in the bay, about 50 miles southwest of Anchorage, to do a little beachcombing. He landed on the beach without incident, but as he was taxiing toward a cove the wind, which was gusting more strongly than he realized, picked up his onshore wingtip and flipped the light plane into the bay. By the time the startled pilot emerged from the cockpit, clutching what few items of his survival gear he could lay hands on, he was already 50 feet from shore and the aircraft was sinking. Struggling out of the 40°F water he lost all of his possessions except the knife in his pocket.

Once ashore he attempted to start a fire with sparks from the knife blade

Wintertime ditching may bring unexpected problems of survival.

struck against stones, but was unsuccessful. Then he managed to find a small cave on the beach which sheltered him from the wind. He was wearing wool knit underwear and a fiber parka which shed water well; most of his discomfort came from his soaked blue jeans and the water in his shoepacs, which he removed. He spent a shivery (20°F) night in the cave, protected from the sub-zero windchill on the beach, and in the morning a C-130 spotted the SOS he had traced in the sand and sent help.

Clothing is defined by Stoffel and LaValla as "shelter close to the body." Clothing's effectiveness against cold is measured by its ability to trap the body's radiated heat with dead air spaces and by its ability to repel moisture. (Wet clothing extracts body heat nearly 200 times faster than dry clothing.)

Wool is unique among clothing materials in its ability to maintain body heat fairly well even after being immersed. This is because wool fibers trap air in tiny pockets, preventing complete saturation. In contrast, cotton saturates readily. Cotton also "wicks" water rapidly from wet to dry areas, and when damp conducts heat away from the body almost as fast as water itself.

One disadvantage of wool is its relatively loose weave, which provides inadequate protection against strong winds. A lightweight outer garment of some synthetic material, such as nylon, solves this problem. Ideally it is best not to depend upon a single massive garment, which could become soaked with rain or from perspiration; easily removable *layers* of clothing work well.

In freezing temperatures, immersion in water causes a drain on your body heat that may be life-threatening. You may be able to blot out some of the water by rolling around in dry snow. If you can remove the soaked garments and shelter yourself otherwise, hang out the wet clothes to freeze and then beat the ice crystals out of them.

As regards *structural* shelters, you have essentially three options: you can use the fuselage interior, you can modify the fuselage with external add-ons, or you can seek other shelter in the environment. If you are injured seriously you do not want to move around unnecessarily, so staying put—once the threat of fire is past—is normally your best bet.

As an overnight home in the snow, an aircraft interior can be deceptively snug—at first. You may find it fairly comfortable as is, in the daytime, but if you make no preparations for the night you could be in serious trouble. Metal, especially aluminum, conducts heat very rapidly. Unless you take pains, while it is still light enough to see, to insulate the metal walls and close off any openings, nightfall will see a tremendous exodus of heat.

During the best part of 24 hours the only source of heat in that aircraft may be your body, and you do not want to overtax it. Use newspapers, charts, cartons, fabric, etc., as insulators, and curtain off all of the interior space that you do not actually take up—thereby reducing the drain on your body "heater." Stuff all cracks and crevices with any suitable material you can find, sealing yourself in as tightly as possible. Anticipate that the outside air temperature will fall steadily through the night, and your ability to function may deteriorate also. Do not be bashful about huddling closely with any other warm body (bodies) in the cabin; the less body surface exposed to the air, the less heat loss.

Even if the fuselage is badly broken up, you may not wish to abandon it—particularly if you are injured, or the snow is deep, or the weather is stormy. Any upright sections of the aircraft can be useful, as a windbreak and/or a support for other adjoining walls you may be able to fashion out of snow blocks, stones, pieces of cowling or fabric, or carpeting, or tree limbs. Having one sturdy wall to begin with will cut down your construction time and allow you to give more attention to devising ingenious means of insulating. Any flooring of snow or damp, cold earth will need some non-conductive padding. Ransack the unused portion of the airplane for such items as seat stuffing, carpeting, sunvisors, plastic interior side panels, floorboards—virtually anything nonmetallic.

If the plane is destroyed by fire, or the terrain is conducive to shelter construction, you may choose the third option. The guiding principle is to use the best materials that are close at hand, and build no larger than the actual space needed to enclose the persons to be protected.

For example, if there is firm snow, you can make a quick shelter out of snow blocks, but do not design something for the cover of "Homes Beautiful." An igloo, which takes many bodies to heat, could be days in the building; a simple trench in the snow with snow blocks arched over for a ceiling could be built in an hour or two and serve your purpose fine. The point is to survive, not to entertain, or set up long range housekeeping. (With satellite ELT tracking, about 98% of the emergency signals are responded to within 72 hours.) The floor should be covered with dead foliage or grass or tree bark, at least four inches (it will compact under your weight). Enclosing the insulation in plastic garbage bags will keep it from hallowing out. Plastic may also be used for windows, to let in sun warmth and allow you to watch for rescue planes. Seal the entrance well, and your body warmth will glaze over the ceiling and refreeze, forming rigid ice girders.

If there are trees nearby you can use deadwood for roofing or walls, in combination with plastic, metal panels, propeller blades, and anything else you can salvage. If you use large garbage bags for the ceiling, just be sure the framework will support any unexpected accumulation of snowfall or rain.

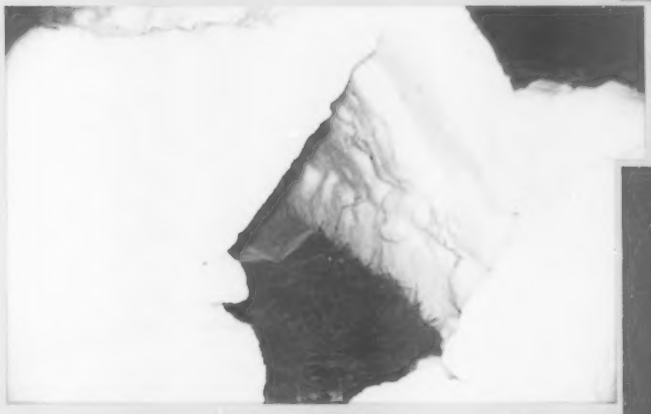
Building a fire for warmth and signalling is important, but in cold weather this is almost always secondary to obtaining a shelter. The colder the weather, the less likely you could survive a night without protection from wind and precipitation. The more forethought you give to bringing outdoor clothing and survival gear with you, the less you will suffer; but once down you are past that. Focus your mind on using what the environment offers, and you may be pleasantly surprised to find what countless other living creatures have known for centuries: you can make a home in the snow. ■

The airplane wreckage has virtually hundreds of potentially usable materials for survival assistance. A few examples:

- Ailerons—snow cutting tools, braces, splints.
- Brake fluid or kerosene from turn and bank indicator—fire starter.
- Control cables—rope for binding, hoisting.
- Disk brake plates—signalling mirror.
- Engine cowl—snow shovels, fire reflector.
- Light lenses—fire starting.
- Nose cone—firepot (when filled with dirt saturated with fuel).

Snow block shelter using tail section of fuselage for support and wind screen.

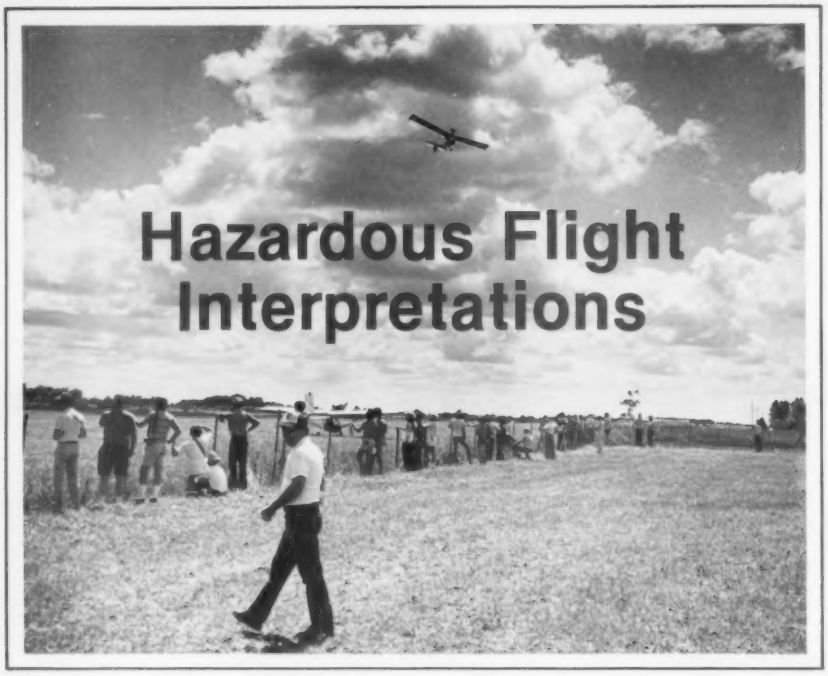
Entrance to "cathedral" ceilinged snow trench, lined with dry pine needles covered with plastic sheet.



Large plastic sheets enclose tree-supported lean-to, built on a thick accumulation of pine needles. Quick and simple, but plastic must be secured against winds.

Heat retention of fuselage interior is improved with dry grass carpet and foil weather strips.

Survival training instructors Patrick LaValla, right, and Skip Stoeffel, far right. Material quoted in this article is from their book, "Survival Sense for Passengers and Pilots." Photos provided by FAA's Northwest Mountain Region.



Hazardous Flight Interpretations

The bane of every pilot—indeed, possibly the "glue" of FAA's regulatory network—is the enforcement action which may be taken for a rule infraction. Ultralight operators as well as aircraft pilots can be assessed up to $1,000 in civil penalties for each regulation violated. Certificated pilots can also face possible suspension or revocation of their certificates. After evaluating a year's data on enforcement actions taken against ultralight operators, it becomes obvious that some individuals may be deliberately disregarding the rules, but others may not understand how the rules apply to them.

For example, of 41 cases involving enforcement action against ultralight operators, 25 involved hazardous operations—Part 103.9(a) of the Federal Aviation Regulations. The rule states, "No person may operate any ultralight vehicle in a manner that creates a hazard to other persons or property." What exactly does this mean? Because any number of circumstances may be considered hazardous, there is no specific definition in the FARs. According to the dictionary, a hazard is something that exposes persons or property to a risk. In enforcement action, FAA applies the standard that *if harm, damage, or threat occurs, then a hazard exists*.

For example, this past February 24, an ultralight operator landed his vehicle on runway 22 at Waimea Kohala, a 5,200′ single-strip airport in the northeast corner of the main island of Hawaii. On the opposing runway (04), a Hawaiian commuter Cessna 402, carrying six persons, was beginning its takeoff roll. To avoid a collision—when it became obvious the ultralight was not turning off the runway—the pilot aborted the takeoff and made a high-speed turn onto the taxiway. The incident was duly reported and the ultralight operator assessed $300 in civil penalties for a hazardous operation: his actions had posed a threat to the aircraft and its occupants.

Assuming that the ultralight operator saw the aircraft preparing to takeoff, but decided he had time to land and clear the runway, his poor judgement created the hazard. If he was unaware that the aircraft had the right of way, his ignorance of the rules was at fault. If he did not see the aircraft, then his lack of vigilance was equally a hazard. Operating at a public airport imposes certain responsibilities on the operator regarding knowledge of rules, vigilance and judgement which are necessary for the safety of flight. The fact that he is not required to be certificated is no excuse.

For certificated pilots, the nearest counterpart to the "Hazardous Operation" rule is FAR Part 91.9 which reads: "No person may operate an aircraft in a careless or reckless manner so as to endanger the life and property of another." Here too, exactly what constitutes careless or reckless is not specifically defined; each allegation is judged on its own merits.

But a review of past FAA enforcement cases shows that "careless" implies an unintentional omission or absence of good practice, such as forgetting to carry appropriate charts or neglecting to maintain a good traffic scan. In other words, the person did not deliberately attempt to "get away" with behavior which he knew was prohibited or risky. "Reckless" is a different and far more serious matter; it alleges the willful disregard of regulations or accepted safety practices without any consideration of the consequences of the action—and consequently endangering persons or property.

For example, in 1978 a Pitts *Special* pilot, fresh from aerobatic training but without an FAA-issued certificate of competency, decided to treat his Iowa hometown to an impromtu display of his newly acquired skills at about 800′ AGL over the town. The aircraft was recognized by several witnesses who reported the incident, and FAA inspectors awaited the pilot when he landed at the airport. It was obvious that anyone who had just completed aerobatic training was aware of the altitude restrictions, so the recklessness of the operation appeared clear-cut. The pilot's certificate was suspended for 90 days.

Complaints about unsafe flying are directed to the nearest Flight Standards District Office. An inspector studies the complaint, and if it appears valid, sends a Notice of Investigation to the alleged violator, requesting his or her version of the incident. When all the facts are assembled, the inspector has the option of taking no further action—due to a lack of evidence; of taking administrative action; or recommending a civil or criminal penalty; or certificate action.

An *administrative action* is usually taken when no significant unsafe condition existed; or where lack of competency or certification was not involved; or when the violation was unintentional—and when the alleged violator's attitude toward complying with regulations is cooperative. A case like this could be wrapped up with either a *warning notice* or a *letter of reprimand*, either of which becomes a part of the airman's permanent record.

If legal enforcement action is sought, it can take the form of civil penalties (fines), certificate action (suspension or revocation), or criminal penalties (jail).

In the case of a *civil penalty*, the pilot or ultralight operator can pay the full amount recommended by FAA (up to $1,000 for each violation), offer a compromise amount which FAA may or may not accept, or refuse to pay in any instance. During any negotiations with FAA, the airman is entitled to be represented by legal counsel. If differences cannot be resolved, FAA will seek to collect the penalty through usual civil court proceedings—a costly and time-consuming process for all concerned. Such cases may be appealed up to the Supreme Court.

In a *certificate action*, the pilot can admit the charges and surrender the certificate; answer the charges in writing; appeal to the National Transportation Safety Board law judge; or request an informal hearing with FAA counsel to discuss the case. Decisions made by the full Board are binding on FAA, but they may be appealed to civil courts by the airman.

Violations that require *criminal penalties* (e.g., forgery of certificates, false aircraft markings, interference with navigation, etc.) will be enforced by the Department of Justice under the U.S. Penal Codes.

The pilot or ultralight operator who wants to avoid all the above rigmarole should remember it pays to be careful in making judgement calls. Otherwise, you will pay in another way for your carelessness. ■

One for the Gipper's Mentor

The fatal crash of a Transcontinental Air Transport Fokker Trimotor on March 31, 1931, at Bazaar, KS, would probably have had little effect on the course of aviation history—except for one notable fact. In that early period flying was still considered a pretty risky business. Less than one percent of the U.S. population had ever set foot in an air carrier, and those who did were thought of as daring individuals who faced death casually.

However, there was one particular passenger on the airplane whose untimely death touched millions of Americans, who had followed his exploits as the mentor of Notre Dame's gridiron heroes from Saturday to Saturday every fall. Who did not know of and admire the plucky Norwegian-born football coach whose passionate half-time exhortations inspired the "Fighting Irish" to an incredible winning record? In those dark days of the Great Depression, Knut Rockne had become a folk hero, a living legend to inspire the disheartened victims of economic stress.

And suddenly he was gone, himself the victim of an air tragedy that had occurred in broad daylight in the heartland of America. The aircraft, a newly designed Fokker F-10A, was built by General Motors, who hoped to see it become the mainstay of the commercial air carrier fleet. But now everyone was asking, was the beloved Rockne's death caused by some fatal flaw, a hidden weakness? Pressing this question, dozens of newspapermen descended on the crash site in Kansas, buttonholing every government official in sight.

The responsible agency, the Aeronautics Branch of the Department of Commerce, had a long-standing policy of telling the public essentially nothing about the causes of air crashes. In addition to looking after air safety the Department was also charged with fostering the growth of the fledgling aviation industry. In this latter role it was very sensitive to the fears of industry leaders that any publicity concerning aviation accidents was bound to discourage potential air travellers.

To quiet the "barking" of the Press, Clarence Young, the head of the Aeronautics Branch, gave out a statement that the airplane was not at fault, the pilot had erred by pulling out of a descent too precipitously, causing wing structural failure (eyewitnesses had seen a portion of the wing break away).

This sounded satisfactory, until some nosey reporter raised questions about chunks of ice found near the wreckage, and a missing propeller.

Young quickly formulated a new theory, explaining that a piece of ice had worked loose from one propeller, causing an imbalance and severe vibration to the engine mount on the wing, leading to its failure.

This theory lasted a full five days—until the accident site was evacuated and the missing propeller blade turned up intact. *Next idea, please?* Insisting that icing was the culprit, Young modified his explanation to the effect that ice had "rendered inoperative certain . . . instruments which caused the aircraft to enter into a steep dive from which it could not be recovered safely." The weary reporters finally went home, and interest in the crash story subsided.

In point of fact, Young and the Aeronautics Branch had a pretty good idea all along as to the cause of the accident. The Fokker's wing was constructed of wood, with a plywood sheathing glued in place. It was not possible to inspect the interior for possible dry rot or other derogation without going through the expensive procedure of stripping off the plywood skin. Young had hesitated to order such an inspection, although complaints had been brought to the Department by maintenance officials.

But five weeks after Rockne's death all Fokker models F-10 and F-10A were abruptly ordered out of passenger service. A public announcement stated that a precautionary inspection would take place and maintenance would be performed on any aircraft that needed it. Later it was disclosed that these inspections had included removal of one wing's plywood sheathing, and that an accumulation of moisture was found to have caused "deterioration of the glue, materially decreasing the strength of the wing, since this type of construction is to a great extent dependent on the glue." In a word, the internal spruce and birch spars were coming unstuck.

Young now had no choice but to order the internal inspection of the wing trussing on all 35 Fokkers in passenger service. Fifteen of these aircraft failed to pass the inspection, although five were later reinstated to service. Thereafter periodic inspection of the wing interior was mandatory. Eventually Young issued a complete ban on this type of wing construction—an advanced concept of the celebrated Dutch aeronautical designer, Anthony Fokker. Fokker returned to Holland in disgust, and General Motors went out of the airplane business.

However, the setback to the American aviation industry was very temporary. In the long run it turned out that an informed public was more willing to help usher in the new age of air transportation than one which had been kept in the dark about its problems. There would be other shocking accidents and the loss of other celebrities over the next few years (including Carole Lombard, and Wiley Post), but the policy of objective investigation and full disclosure resulted in continuing public support. The final step toward assuring complete objectivity was the eventual separation of the investigating authority from the regulatory agency, leading to creation of a National Transportation Safety Board and the Federal Aviation Administration.

(Material for this article was drawn largely from the recent historical book, *Bonfires to Beacons*, by Nick A. Komons.) ■

More for Your Money

A reading list, free and otherwise

I'm sure many pilots will agree with C. Kent's letter in the July/August 1983 issue. The subscription rate is a bit high for six issues of FAA GENERAL AVIATION NEWS. So, perhaps you could help us "poor pilots" by publishing a list of free publications, booklets, etc., available from FAA or the Government Printing Office, that are relevant to general aviation. Hopefully, such free materials exist and, if so, they would be more effective in taxpaying pilots' hands than collecting dust in a government warehouse!

Burt Comptom
Miami, FL

Fair enough, but the number of free publications that would be of interest to general aviation pilots is so large that they would fill up most of the magazine. All available ACs (including nongratuitous ones) are listed in the Advisory Circular Checklist AC 00-22WW, available (free!) from DOT Publications Branch, M-442.32, Washington, DC 20590. To expedite service a self-addressed mailing label would be helpful.

Once you have the checklist you may identify, by title and subject numbers, the advisory circulars which you would like to receive on a continuing basis, as they are revised and updated. Request this service from a different office: DOT Requirements Section, M-481.1, Washington, DC 20590.

Note that the AC numbers correspond to the Part numbers of applicable Federal Aviation Regulations. Also, keep in mind exactly what you are requesting. For example, under the "60" general subject area, separate mailing lists for advisory circulars issues in the 61, 63, 65 or 67 series are available. However, an AC mailing list numbered simply "60" will bring you all of the numbers in the 60 series—which you may or may not want.

A Sampling of Available AC's

General

Subject No. 00

00-2WW Advisory Circular Checklist (3-15-83)
Transmits the revised checklist of current FAA advisory circulars as of March 15, 1983.

00-24B Thunderstorms (1-20-83).
Describes the hazards of thunderstorms to aviation and offers guidance to help prevent accidents caused by thunderstorms.

00-46B Aviation Safety Reporting Program (6-15-79).
Describes FAA's Program which utilizes NASA as a third party to receive and analyze Aviation Safety Reports. This cooperative safety reporting program invites users of the National Aviation System to report to NASA actual or potential discrepancies and deficiencies involving the safety of aviation operations.

00-50A Low Level Wind Shear (1-23-79).
Provides guidance for recognizing the meteorological situations that produce the phenomenon widely known as low level wind shear.

Aircraft

Subject No. 20

20-73 Aircraft Ice Protection (4-21-71).
Provides information relating to the substantiation of ice protection systems on aircraft.

20-93 Flutter Due to Ice or Foreign Substance on or in Aircraft Control Surfaces (1-29-76).
Provides information concerning the potential hazard associated with aircraft control surface flutter caused by imbalance.

Airmen

Subject No. 60

60-12 Availability of Industry-Developed Guidelines for the Conduct of the Biennial Flight Review (2-11-76).
Informs all FAA certificated flight instructors of the availability of, and how to obtain, the industry-developed guidelines for the conduct of the Biennial Flight Review.

61-91C Pilot Proficiency Award Program (6-1-83).
Describes the Pilot Proficiency Award Program, outlines the eligibility requirements.

Air Traffic Control and General Operations

Subject No. 90

91-13C Cold Weather Operation of Aircraft (7-24-79).
Provides background and guidelines relating to operation of aircraft in the colder climates where wide temperature changes may occur.

91-44A Operational and Maintenance Practices for Emergency Locator Transmitters and Receivers (12-2-80).
Combines and updates material in several Advisory Circulars on the subject of emergency locator transmitters (ELT) and receivers for airborne service.

91-51 Airplane Deice and Anti-Ice Systems (9-15-77).
Provides information to pilots regarding ice protection system approval and the results of in-flight icing.

91.83-1B Cancelling or Closing Flight Plans (6-24-82).
Explains FAA procedures for handling flight plans and emphasizes the need for cancelling or closing flight plans.

103-1 Industry Ultralight Safety Program (Not yet available).

103-6 Ultralight Vehicle Operations—Airports, Air Traffic Control, and Weather (6-23-83).

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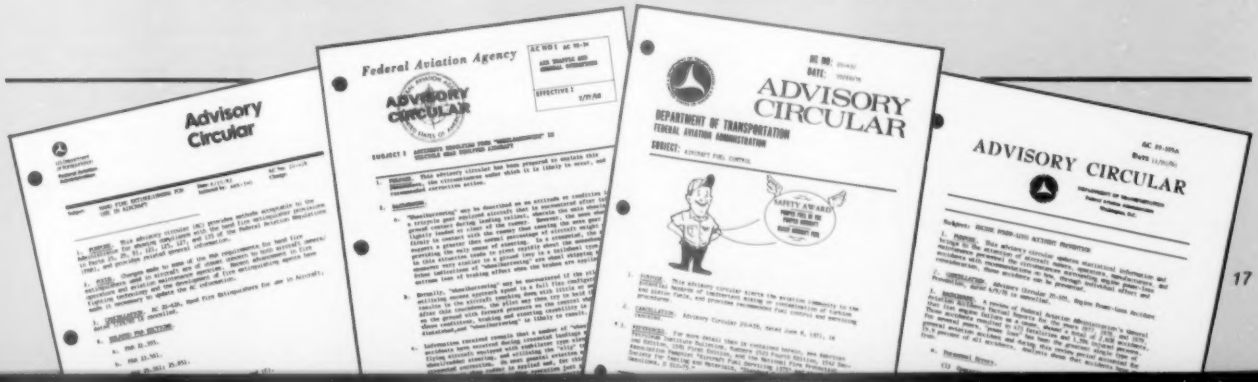

OLD SOLUTION TO A NEW PROBLEM. When Spokane's Felts Field tower went part-time last year, airport officials worried about how transient traffic would handle the mirror-image patterns of the parallel runways without voice guidance. So they dredged up the fast-disappearing segmented circle with a unique twist—dual direction indicators.

CONSOLIDATED TEST GUIDE CHANGES BEGIN MARCH 1

Beginning March 1, 1984, candidates for pilot certificates or new certificate ratings may find a welcome change in their written test study guides. Instead of a separate study guide for each certificate and rating, the booklets will be consolidated to include all subject matter appropriate to a particular airman certificate and its related categories or ratings. This will decrease considerably the number of guides some pilots will have to buy in preparing for testing.

For example, the private pilot study guide would contain questions on the airplane, rotorcraft, glider, and lighter-than-air private pilot written tests. There would be a total of 11 study guides under the new system, compared to about 20 previously.

The new written test guide will be used as a source for all questions in the examination booklet and will no longer be issued as an advisory circular. The test guides will also contain an appendix listing references where answers to each question can be found.

Another significant change is that applicant will receive a test report form from FAA showing their actual score and indicating (by number) the specific questions they have incorrectly answered.

The new question books, available *after* March 1, 1984 from the Superintendent of Documents, Government Printing Office, Washington, DC, 20402, are:

- Private Pilot Question Book, FAA-T-8080-1
- Commercial Pilot Question Book, FAA-T-8080-2
- Flight Instructor Question Book, FAA-T-8080-3
- Fundamentals of Instruction and Ground Instructor Question Book, FAA-T-8080-4
- ATP—Airplane (Part 121) Question Book, FAA-T-8080-5 (includes Flight Navigator and Aircraft Dispatcher)
- ATP—Airplane (Part 135) Question Book, FAA-T-8080-6 (includes ATP Helicopter IFR, ATP Helicopter VFR, and ATP Gyroplane VFR)
- Instrument Rating Question Book, FAA-T-8080-7
- Flight Engineer Question Book, FAA-T-8080-8
- Aviation Mechanic General Question Book, FAA-T-8080-10
- Aviation Mechanic Powerplant Question Book, FAA-T-8080-11
- Aviation Mechanic Airframe Question Book, FAA-T-8080-12

Send check, money order, or credit card number. Check current price with GPO before ordering.

APPROVED CHILD SEATS LISTED

FAA has issued a list of child restraint seats approved for use in air carrier and general aviation aircraft. The following models may be used:

Cosco/Peterson	78( )Safe-T-Seat
Century	4100 (Century 100)
"	4200 (Century 200)
"	4300 (Century 300)
"	4500 (Century Infant Love Seat)

Pilots of general aviation aircraft are cautioned to make sure the infant seats do not interfere with dual controls in front seat use. Air carrier passengers should check with airlines before flight to make sure they will accept these seats free or if they require purchase of a ticket.

"PRIVATE LINE" TRANSPONDERS

Aircraft owners familiar with recent costs for installation or replacement of Mode C transponders will be interested in an advance notice of Proposed rulemaking (ANPRM) concerning the use of Mode S transponders. FAA is seeking comments on estimated Mode S benefits and costs, as well as general comments on proposed changes to Federal Air Regulations (Parts 43, 91, 121, 127, and 135) affecting flight in certain airspace and over 12,500′. The Mode S transponder offers several additional features, notably a capability for discrete address and for transmitting messages by datalink.

Under this proposal Part 91 (General Operating Rules) would be amended to require either a current altitude encoding (Mode C) or a Mode S transponder for operating in terminal control areas and in airspace above 12,500′ MSL (excluding airspace at and below 2,500′ AGL). Similar provisions in Part 121, 127, and 135 would also be changed accordingly.

FAA estimates a Mode S transponder would cost $1,735 in a new aircraft and $1,811 for a retrofit, with an additional $400 each if solid-state equipment is used. (This compares to recent estimates of $1,353 for new and $1,422 for a retrofit of a current altitude-encoding transponder.) FAA is also seeking maintenance cost information for a more detailed comparison of Mode S and current transponders. This includes any comments or studies on:

1. expected useful life of current transponders
2. age distribution of current transponders by fleet
3. production history of current transponders by type for the past 15 years
4. annual maintenance costs for current transponders by type and age
5. anticipated major repairs for current transponders

A free copy of ANPRM No. 83-16 may be obtained from the FAA Public Information Center, APA-430, 800 Independence Ave., S.W., Washington, DC, 20591. Comments should be sent no later than January 17, 1984 to FAA Office of the Chief Counsel, AGC-204, Docket No. 23799, same street address.

LATEST AIRMAN PUBLICATIONS

Certificating Rotorcraft

Rotorcraft manufacturers, engineers, and test pilots will be interested in new Advisory Circular 29-2, "Certification of Transport Category Rotorcraft." The circular consolidates in one volume FAA guidance on helicopter certification over the past 25 years. AC 29-2 may be purchased from Superintendent of Documents, Government Printing Office, Washington, DC, 20402. Check price before ordering.

Chart Catalog

The "Catalog of Aeronautical Charts and Related Publications" 1983-1984 edition is available free from NOAA Distribution Branch, N/CG33, National Ocean Service, Riverdale, MD, 20737.

• Out of Sight

I am interested in breaking the current highest skydive record now held by the U.S.S.R. The dive would be from a balloon, and I have people willing to make the jump. But what I need is information about how to go about obtaining the necessary documents, permissions, etc., since the jump would be made from over 125,000 feet. I don't want to be shot down as a U.F.O.! A jump like this isn't an everyday event, and I really need to know who to get the right information from. Also, do you know of any businesses, companies, and so on that would be interested in sponsoring us in our attempt?

Kenn Rick
Lake Orion, MI

Your local Flight Standards office is in the best position to answer your questions about preparations for your proposed jumped. In your area contact FAA General Aviation District Office No. 20, Willow Run Airport—East Side, 8800 Beck Rd., Belleville, MI, 48111; (313) 485-2550.

Obtaining backing from businesses is something we cannot help you with. However, for further assistance, contact the United States Parachute Association, 1440 Duke St., Alexandria, VA, 22314; (703) 836-3495. I'm sure they would be very interested in your project.

Incidentally, the current highest skydive record, held by the U.S.S.R., was set in 1962 at an altitude of 80,360 feet.

• When Is a CZ Not a CZ?

Some of my flight instructor colleagues teach that a control zone does not "exist" except when weather is below VFR minimums for the CZ? I maintain that a CZ always "exists" where depicted on the charts. What is your opinion?

B. Marcey
St. Augustine, FL

A control zone is not contingent upon weather minimums for its existence. The zone and its hours of operation are established by regulation in Part 71 of the Federal Aviation Regulations.

• Pistol Packin' Pilot

I happened to come across an old issue of your magazine, and I have a question. In the September/October 1982 article "Freeze-Up" you mention a young woman who was intimidated by her instructor-cop's firearm: Isn't there some regulation about carrying a gun aboard an aircraft?

Rod Slotten
St. Charles, IL

Firearms and ammunition must be carried unloaded in check baggage on air carrier aircraft except by authorized law enforcement officers escorting prisoners or on other duty where the firearm is considered necessary. For aircraft operated under Part 91 there are no restrictions except those imposed by the aircraft operator and any local laws that might be applicable.

• The Customer is Right

I feel your answer to C. Kent in the "Forum" article "Pater Familias" (July/August 1983) is totally unsatisfactory and puts the FAA in a bad light. The real reason FAA General Aviation News *is a good buy is that it has no advertisements and is not cleverly laid out like commercial magazine to make it seem larger.*

I have purchased the News *since it was $2.50 and was published monthly, and I hope the reason it now costs $14.00 is because that is what it takes to cover the publishing costs. I have already dropped my subscription to the* Airman's Information Manual *because it got too expensive and I had to choose between the subscription costs and $1.99/gal. fuel costs. Most of us do not have the money to keep paying, and we would rather put our money to the actual flying and maintaining of our aircraft, so if you are really interested in safety, don't price us out of the air or out of your fine publication. Remember, if we don't fly, you're out of a job!*

A. Sozio
Foxboro, MA

Can't argue with that.

• The Wright Stuff

In reading your July/August 1983 article on "Mechanic vs Repairman," my Inspection Authorization holder encountered some questions that we feel should be clarified. On a chart titled "Aviation Technician Licenses," under the heading "Qualifications" for the Airframe and Powerplant Certificate, you state a student must pass an FAA Written and Oral test. Nowhere do you mention the Practical. Does this mean FAA is going to do away with the practical?

Also, under the column titled "Privileges" for the Inspection Authorization you list the following: "Performs or supervises Annual or Progressive Inspections." Part 65.95(a)(2) states that an AI must perform an annual, not supervise it. Only a Progressive Inspection may be supervised. Are we misreading something or did you misquote the reg?

Dave L. Wright
Suisun City, CA

The requirement for a practical test (FAR 65.79) was inadvertently omitted from the chart, and you are correct; Part 65.95 was misquoted.

• Winter Flying Hazard

I encountered a winter-related problem last year, and I thought since that season is upon us again, I should pass it on.

The weather was clear and sunny; the temperature about −2°C. Asphalt runway and taxi way had some slushy snow remaining on the surface in widely scattered spots. The sun on the dark asphalt was melting the snow although the air temperature was just below freezing.

After a normal takeoff in a low-wing plane I noticed a considerable number of ice "blobs," some as big as almonds, frozen to the leading edge of the wings at about six feet out from the fuselage. They had obviously been thrown up by the propeller wash when passing through slush either on the taxiway or runway. A check of airspeed showed no particular reduction of lift, but then my plane was an RF5B Motorglider with a 56-foot wingspan, so only a minor part of the wing was affected—probably what saved me. The ice evaporated after about 15 minutes.

It would seem to me that a shorter-winged aircraft could be very adversely affected by that kind of ice on the leading edges. Am I right?

Stuart L. Faber
Cincinnati, OH

Absolutely. Any amount of ice, snow, or frost on a wing of any length can disturb the lift. In this season taxi slowly and avoid run-ups on slushy surfaces. Also, visually check the wings before takeoff.

FAA GENERAL AVIATION NEWS welcomes comments from our readers. No anonymous letters will be used, but names will be withheld on request. Address: FAA GENERAL AVIATION NEWS, AFO-807, Washington, D.C. 20591.

• A Mere Lad

I can't help being impressed by the longevity of those pilots you wrote about who fly the wilderness country in Idaho. According to the caption on page nine Bill Dorris is an ex-Marine flyer from World War I. Assuming he was no more than 20 at the time that would put him up in his mid eighties. He must have filled up a lot of logbooks.

William Adler, M.D.
Fairfield, Conn.

A typographical error added an unwarranted burden of years to Mr. Dorris. Still I would not be surprised to see the WW-II veteran go on logging time into the next century.

• Student PIC?

Is a student pilot, when he or she is the sole occupant of an aircraft, the pilot-in-command? A flight instructor I know says an airplane with only a student pilot in it has no PIC. Is he right?

Francis Zwingli
New Glarus, WI

The definition of pilot in command, as given in Far Part 1, is ". . . the pilot responsible for the operation and safety of an aircraft during flight time." Therefore the solo student would be PIC.

INSTRUMENT CORNER

• IFR Currency Rules

Has there been any discussion recently about revising the IFR currency rule? My instrument instructor used to tell me that while the six approaches required for currency represented a useful and valid measure of the IFR pilot's skill, the requirement of a minimum of six hours of instrument time logged for each currency period did not, since it is no real chore to fly straight and level on instruments once you've had the training. Approaches are much more demanding. These and actual time in instrument conditions are what really count.

So what can I do to prod the FAA into considering the merits of a change (I have a few ideas) in the regulations concerning IFR Currency?

Dr. Newton W. Miller
Redlands, CA

At present, there are no plans to review the instrument currency requirements. However, any interested citizen may file a petition for rulemaking. Essentially the procedure consists of submitting the proposed change or amendment in duplicate to the Rules Docket of FAA Office of the Chief Counsel. Set forth the substance of the rule, explain the petitioner's interest, submit any arguments supporting your position, and include a summary for publication in the *Federal Register*.

Complete details are contained in Part 11.25 of the Federal Aviation Regulations, which may be examined at your nearest flight standards field office, or purchased from Superintendent of Documents, Government Printing Office, Washington, DC, 20402. Check price before ordering.

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Satellite Saves *(continued from p. 10)*

hundreds of frustrating searches) could be virtually eliminated by pilot and aircraft owner action. Simply take the precaution of removing the batteries (or battery pack) before transporting the instrument. In most cases this is a relatively easy matter—terminals may be taped over to prevent short-circuiting. (When re-installing the portable ELT in the aircraft, turn it on and check for normal performance by means of the aircraft radio.)

Just placing the ELT in the "disarmed" mode during storage is no guarantee that it will not be activated by a bump, a child's play, electrical shorting or other causes. *No* batteries means *no* signal. Simple as that. This procedures also assures you that the instrument will not be weakened or silenced by worn-out batteries in the event some day *you* become the downed pilot in need of urgent help.

For aircraft with permanent ELT installations, *hard landing* activation can best be detected by habitually listening for the signal on 121.5 on your aircraft radio after shutdown. Alternately you can buy a small portable VHF or FM radio that will pick up emergency signals at close range for a few dollars. Keep it in your flight bag for preflight and postflight checking of the ELT.

> To check for ELT activity, touch the coaxial cable with a moistened fingertip, or your tongue, for slight tingle. If the antenna is broken off, virtually any metal rod, even a ballpoint pen tip jammed up against the cable will give you some range.

The third category, *Other G-switch activations*, refers generally to false alarms set off during shipment of the transmitter, either by the manufacturer to an outlet or by an owner or mechanic for purposes of repair. You can help the current educational crusade on this subject by requesting that any ELT sent to you or for you have the batteries shipped *separately*.

The question as to why the ELT signal cannot be made audible to the unaided ear or to the crew in the cockpit, and thus eliminate the problem, has been raised many times. Technically this is not quite as simple a matter as it sounds, especially if cost is a consideration—and indeed it is to most general aviation pilots. The cost of simply providing each aircraft owner with a (separate) monitoring device for each aircraft has been estimated at over $5.2 million.

Rather than seeking a quick fix, the present emphasis is on designing a new generation of ELTs that will provide foolproof warning of activation without overburdening the owner's wallet. Technical Standard Orders for ELTs which will have a cockpit warning device are expected to be approved early in 1984, and may be on the market next summer. That will not prevent false transmissions from garages, car trunks, mailboxes, etc., but is a step in the right direction. Until the final solution is in sight (it is at least several years away) the ELT satellite tracking program is depending upon voluntary efforts by all airmen to prevent a deluge of false alarms from drowning rescue efforts in a sea of meaningless squawks. ■

Phoney transmissions

Give us conniptions.